



UNIT

7

Applications of AI

Student Learning Outcomes

By the end of this chapter, you will be able to:

- Explain how AI can be applied to specific applications in areas like NLP, Robotics, Speech Recognition.
- Conduct a technology recognition experiment where students interact with products based on NLP, Robotics, Speech Recognition.
- Discuss the benefits and limitations of NLP, Robotics, Speech Recognition, and others
- Show that there are instances where use of AI causes social injustices.
- Develop critical thinking skills to assess situations where AI has led to social injustices and identify potential areas of improvement.
- Effectively communicate the social implications of AI, particularly regarding injustices and ethical responsibilities, both in writing and verbally.
- Exhibit an awareness of ethical considerations in AI development and usage, as well as the potential consequences of overlooking these considerations.
- Analyze case studies or scenarios where AI has caused social injustices, and discuss the underlying factors contributing to these issues.

Introduction

Computer Science is not just about using computers, it is about solving problems, creating smart tools, and making life easier. One of the most important sub field of modern computer science is Artificial Intelligence (AI). Natural Language Processing (NLP) helps computers understand human language. Chatbots, text analysis tools, and automatic translation apps are all part of NLP. Speech technology powers voice assistants like Alexa and Google Assistant. Recommendation systems suggest audios, videos, or products based on what users like. Autonomous vehicles, such as self-driving cars, use AI to move safely without drivers. Robotics is used in factories, hospitals, and even space missions.

AI must be used fairly and safely. It is important to study ethics, so that AI does



not harm people or create social injustices. Some systems may show bias or make unfair decisions if they are not designed carefully. That's why students and future developers must learn about data privacy, accountability, and ethical rules for creating AI tools. This chapter will also teach how to think critically about AI, recognize both its benefits and risks, and understand how AI affects jobs, education, health, and society.

7.1 Artificial Intelligence (AI)

Artificial Intelligence (AI) is a modern field of computer science that teaches machines how to "think" and "act" like humans. It helps computers solve problems, learn from data, and make smart decisions without being told what to do step by step. AI is used in many areas such as mobile apps, online shopping, health care, and transportation. For example, when you use a voice assistant like Google assistant or a chatbot on a website, you are using AI. It helps doctors find diseases, drivers use maps, and students find answers online.



Figure 7.1: AI helping people



TIDBIT

AI can now write stories, solve math problems, and even create art, just like a human!



ACTIVITY

"AI Around Us" Poster Task

Students will work in pairs to create a small poster showing how AI is used in different parts of society — such as hospitals, schools, or banks. They can draw, use magazine cutouts, or describe with words. Posters will be shared in class to understand AI's importance in different sectors.

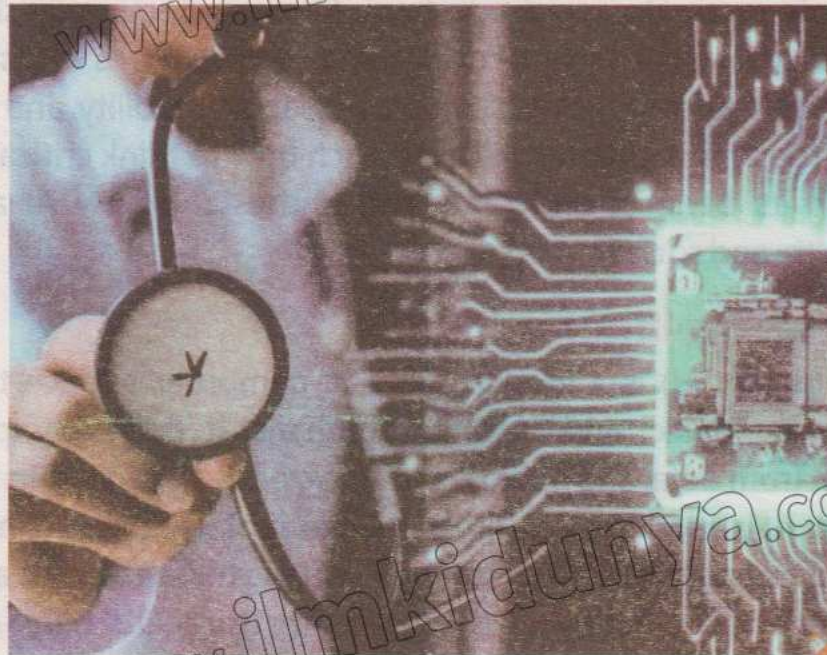


Figure 7.1 AI helps doctors in the diagnosis of diseases

Impact of AI on Jobs and Work?

AI is changing the way people work in many fields. In factories, robots and machines now do jobs that were once done by human experts. These machines can work faster, longer, and with fewer mistakes. At the same time, AI is also creating new kinds of jobs. People are needed to design, test, and manage AI systems. Jobs like data scientist, AI developer, and machine learning engineer are growing fast.



ACTIVITY

"Before and After AI" Chart

Students will be given a worksheet with two columns: "Before AI" and "After AI." They will list jobs or tasks that humans experts used to do and how AI now helps with or replaces those jobs.

7.2 Data and AI

Data is the most important part of AI. AI depends on data to learn, just like a student learns by reading books. If the data is large and correct, the AI system becomes smarter and gives better results.



An AI trained with poor-quality data can give wrong answers or make unfair decisions.



Automatic Data Collection

Automatic data collection means gathering information without needing a person to enter it by hand. Many devices and applications can collect data on their own. For example, mobile phones collect location, usage, and search history automatically. Online websites also collect user clicks, views, and preferences.

ACTIVITY

"What Data Do Apps Collect?" Survey

Students will check 2–3 apps on their phone and note what kind of data the app collects (location, voice, clicks, search history).

With automatic collection, AI can adjust and respond to user needs quickly. It also saves time, reduces errors, and allows systems to work without needing human input all the time.

Types of Data: Quality and Quantity

In Artificial Intelligence (AI), the type of data used is very important. "Quantity refers to how much data is available". When an AI system receives a large number of examples, it becomes more familiar with different situations. For instance, if a machine sees many different images or texts, it becomes better at understanding new ones. "Quality means how useful and correct the data is". If the data has mistakes, missing values, or confusing labels, the AI may learn the wrong things. Therefore, both the amount and the accuracy of data play a big role in building strong AI systems.



AI learns better with both types of data: big (quantity) and accurate (quality).

ACTIVITY

"Clean vs. Dirty Data" Matching Task

Students are given two small data tables: one with clear (good quality) and one with missing or wrong details (bad quality). They match questions to each table and realize how difficult it is for AI to make good decisions with poor data.



7.3 Real-World Applications of AI

AI is now used in many areas of daily life. It helps businesses, schools, hospitals, and even homes become smarter and more efficient. These are real uses of AI that make work easier and faster.

Natural Language Processing (NLP)

Natural Language Processing (NLP) is a part of AI that helps computers understand human language. It allows machines to read text, listen to speech, and give answers in a way people can understand. For example, when someone types a question in a search bar or talks to a voice assistant, NLP helps the AI system understand and reply correctly (as shown in Figure 7.3). In customer service, it helps answer common questions without human help.



TIDBIT

Chatbots on websites can answer your questions 24/7, all thanks to NLP.



Figure 7.3: Talking Chatbot helps people

Robotics in Everyday Life

Robotics is an important sub field of AI that involves machines designed to do tasks like humans. These machines are called robots. They can perform tasks like lifting heavy items, helping in surgeries, or cleaning floors intelligently. Robots



can help old or disabled people with simple daily tasks. Because robots do not get tired and can work with great accuracy.



Robots are now used in some restaurants to serve food and clean tables.

Speech Technology and Voice Control

Speech technology is a type of AI that allows computers to listen and understand spoken words. It helps machines turn voice into text and respond with answers. Voice assistants like those used in phones or smart devices are examples of this technology. For example, in customer service, it helps answer calls and guide users without a human operator. In smart homes, people can control lights or devices just by speaking. In healthcare, it can help doctors record notes without typing. Speech technology makes it easier and faster for people to use machines with just their voice.



TIDBIT

Smartphones can now unlock using your voice, no need to touch anything.



Some cars now respond to voice commands to turn on music, make calls, or give directions.



ACTIVITY

"Speak and See" Practice

Using a phone or computer, students try out voice-to-text tools (like Google Voice Typing). They speak a sentence and see if the tool types it correctly. Then they try speaking in different tones or speeds and compare the results.

Recommendation Systems

Recommendation systems are a part of AI that give users suggestions based on their likes and past actions. These systems study what a person has viewed, searched, or selected before, and then show similar options. For example, on an online shopping website, if someone looks at school bags, the AI may suggest other types of bags or related items. In education, a website can suggest helpful videos or articles based on a student's learning history. Recommendation



systems improve the user experience by making content more personal and useful. However, these systems must be used carefully to protect privacy and avoid showing the same types of content again and again.



TIDBIT

When YouTube shows you "videos you may like," that's AI learning your interests.



ACTIVITY

"Guess My Choice" Simulation

Each student secretly picks a favorite type of video or item. The teacher shows different choices (e.g., comedy, sports, cooking). Based on previous choices, students try to "recommend" the next item to each other. This mimics how AI makes suggestions based on past behavior.

Autonomous Vehicles (Self-driving Vehicles)

Autonomous vehicles, also called self-driving vehicles, are vehicles that can move on the road without a human driver. These vehicles use AI to understand their surroundings and make decisions on their own. They are equipped with smart sensors, cameras, Global Positioning System (GPS), and radars to detect traffic lights, road signs, other vehicles, and people on foot. With the help of these tools and AI, the car can safely speed up, slow down, turn, and stop when needed. They can reduce the number of road accidents caused by human mistakes such as distraction or tiredness. They can also help people who are unable to drive, such as the elderly or disabled.

However, there are also some challenges. These vehicles must be tested many times to make sure they are safe in all situations. There are also concerns about job loss for drivers and the need for strong traffic laws for AI systems. People also worry about who is responsible if a self-driving car causes an accident. That's why engineers, governments, and companies are working together to improve safety and create fair rules for these smart vehicles.



ACTIVITY

"Map the Journey" Planning Task

Students draw a map from their school to a park or market. Then they mark what a self-driving car would need to detect (like traffic lights, people crossing, or road signs).



Figure 7.1 Self-Driving car

7.4 Benefits and Challenges of AI Applications

AI applications are helping people complete tasks faster and more easily. In offices, AI systems manage files, answer questions. In education, AI can guide students with smart learning apps that adjust to their level. This saves time and helps people focus on more important decisions. At the same time, AI supports businesses in planning, predicting sales, and giving better service. These smart tools are improving lives by reducing human errors and increasing efficiency in many fields like agriculture, banking, and transport etc.

Limitations and Challenges of AI Applications

AI systems are not always correct and sometimes give wrong results if the data is low quality or biased. A chatbot, for example, might misunderstand a question if the language is unclear. In fields like law or health, small AI mistakes can cause big problems. That is why careful testing is needed. Another challenge is that AI can replace human workers in many jobs e.g., customer services, data entry and clerical works which may lead to job loss. Also, many AI systems cannot make fair decisions if they are not designed carefully.



AI systems can make mistakes if they are trained on incomplete or biased data.



7.5 Ethics, Fairness, and Social Impact of AI

Ethics in AI means using AI in a way that is fair, honest, and safe for everyone. Since AI can make decisions, it is important to make sure those decisions do not hurt people or treat anyone unfairly. For example, if an AI system gives better service to one group of people and ignores others, it is not fair. AI should be developed with care, keeping in mind fairness, safety, and respect for human rights.



TIDBIT

AI can be unfair if not designed properly that's why developers must think about what's right and wrong.

Bias in AI and Algorithms

Bias in AI happens when the system gives unfair results because of the data it was trained on. If the data only represents one group of people, the AI may not understand or treat other groups fairly. For example, a face recognition tool may not work well for all skin colors if it was trained mostly on images of only one type. This shows that data should include different people, languages, and situations. Removing bias is a big step toward making AI more fair and helpful for all.



ACTIVITY

"Same Input, Different Output?" Game

Students are given a pretend AI that gives random or unfair results based on the name, color, or gender of users. They analyze whether this is fair and how real-life AI systems can become biased if not designed carefully.

Fairness and Transparency in AI

Fairness in AI means that the system should treat all users equally, no matter their race, gender, age, or background. This is important in systems that make decisions about Human Rights, school admissions, job interviews, or legal cases. To ensure fairness, AI must be trained on data that includes all related types of people and situations.

Transparency means that people should understand how an AI system works and why it made a certain decision. If an AI rejects a loan application or selects a student, users have the right to know what rules or steps the system followed.



Transparency helps avoid mistakes and gives confidence that the system is working honestly.

ACTIVITY

"Explain Your Choice" AI Role Play

One student plays "AI," and others ask it to make a choice (like selecting a student for a prize). The AI must explain the reason.

Privacy, Data Security, and Surveillance

Privacy means keeping personal information safe and not sharing it without permission. Many AI systems collect data from users, such as names, addresses, location, or search history. If this data is not protected, it can be stolen or misused.

Data security means protecting information from hackers, viruses, or other attacks. AI systems must use strong security methods to keep user data safe.

Surveillance is when systems or cameras watch people's actions. While it can help in safety, it must be used carefully. Watching people all the time without reason can harm freedom and privacy.

AI and Social Equity (Fairness in Society)

AI should be used in a way that helps all people equally, including the poor, disabled, and those living in remote areas. Sometimes, new technologies like AI are only available to rich or educated groups, while others are left behind. This creates a gap between people. To support fairness in society, AI tools should be designed so everyone can benefit, not just a few.

ACTIVITY

"AI for All" Poster Drawing

Students create a poster showing how AI should help everyone ; rich or poor, city or village. Posters should show fairness and equal access.

7.6 Responsibility of AI Designers

AI systems do not make rules by themselves; they follow instructions created by human designers. This means the people who build AI have a big responsibility to make sure their systems are fair, safe, and helpful for society. If an AI system makes a wrong decision or treats someone unfairly, the mistake often comes from the way it was designed. That is why AI designers must think



carefully about how their tools will affect people in real life. Making AI that is helpful and trustworthy is not just a technical job it is a moral duty.



AI is only as good as the people who build it, that's why designers must act responsibly.



ACTIVITY

"Build a Fair System" Brainstorm

In small groups, students design a fair AI system (e.g., for school admissions or job selection). They list what rules they will follow to avoid bias, mistakes, or harm.

Following Ethics in AI

Ethics in AI means doing what is right and fair when creating or using AI systems. AI designers must make sure their systems do not hurt people, spread false information or treat anyone unfairly. Ethics help designers make decisions that protect users and support justice. Following ethics also includes being honest about how the AI system works. Users should know what data is being used and how decisions are made. Ethical design builds trust between people and technology.



ACTIVITIES

"Right or Wrong?" Ethics Quiz

The teacher reads short AI situations (e.g., spying, unfair selection). Students vote: Is this right or wrong? Then they explain their answer.

Activity (NLP):

Type a sentence in English into Google Translate or a translation app, and convert it into Urdu. Then change a few words and try again.

Activity (Robotics):

Watch a short video of a robot performing a task (like assembling parts, serving food, or cleaning).

After watching, write 3 lines about:

- What the robot did
- How AI helped it
- What would happen if it made a mistake

Activity (Speech Recognition):

Use voice typing on a phone or computer (e.g., Google Docs voice typing). Speak a sentence and watch the text appear. Then speak a different sentence and check if the text is correct.



Summary

- **AI** Field of computer science that teaches machines to "think" and "act" like humans
- **AI capabilities:** Solve problems, learn from data, make smart decisions without step-by-step instructions
- **Real-world applications of AI :** Mobile apps, online shopping, healthcare, transportation, voice assistants
- **Impact on jobs:** Replaces some jobs (factory work) but creates new ones (AI developers, data scientists)
- **Autonomous Vehicles:** Self-driving cars using sensors, cameras, GPS, and AI. It Reduces accidents, and provide assistance for disabled/elderly people.
- **Fairness:** Equal treatment regardless of race, gender, age, background
- **Transparency:** Understandable decision-making processes
- **NLP:** Natural Language Processing helps computers understand human language



EXERCISE

Multiple Choice Questions

1. What does AI stand for?

- a) Automatic Intelligence
- b) Artificial Intelligence
- c) Active Interface
- d) Applied Information

2. Which of the following is an example of Natural Language Processing (NLP)?

- a) Online calculator
- b) Voice typing
- c) File copying
- d) Image editing

3. What type of data helps AI make better decisions?

- a) Short and weak data
- b) Only images
- c) Large and good quality data
- d) Data without labels

4. Which tool uses AI to understand human voice?

- a) Video player
- b) Translator
- c) Speech recognition
- d) Mouse

5. What is the role of robots in factories?

- a) Watching videos
- b) Making websites
- c) Doing repeated or dangerous tasks
- d) Writing stories

6. What is a challenge of using AI?

- a) It works slowly
- b) It cannot be turned off
- c) It may replace human jobs
- d) It cannot store data

7. If data represents only a group of people it is called:

- a) Unbiased data
- b) Biased data
- c) Good data
- d) Reliable data

8. Why is fairness important in AI?

- a) So the system looks good
- b) To avoid slow speed
- c) To give equal treatment to all users
- d) To use more memory

9. Which of these is NOT an AI tool?

- a) Chatbot
- b) Face detection
- c) Spell checker
- d) Paper notebook



Short Questions

1. What is Artificial Intelligence (AI)?
2. How is AI used in daily life?
3. Why does AI need large and good-quality data?
4. What is the role of Natural Language Processing (NLP)?
5. Give one example of robotics in everyday life.
6. What is the purpose of speech recognition technology?
7. How do recommendation systems work?
8. What is meant by bias in AI systems?
9. Why should AI systems be transparent and fair?

Long Questions

1. What is the importance of data in AI? Explain why good and large data is needed.
2. Write in detail about any three real-world applications of AI (such as NLP, robotics, or speech technology).
3. Explain the ethical issues in AI. Why are fairness, privacy, and transparency important?

Answer Key for Multiple Choice Questions

1. **b)** - Artificial Intelligence
2. **b)** - Voice typing
3. **c)** - Large and good quality data
4. **c)** - Speech recognition
5. **c)** - Doing repeated or dangerous tasks
6. **c)** - It may replace human jobs
7. **b)** - Biased data
8. **c)** - To give equal treatment to all users
9. **d)** - Paper notebook